

What is claimed is;

1. A driving assist system for a vehicle, comprising:
a state recognition device that detects a vehicle
5 condition and a traveling environment of a subject vehicle;
a future state prediction device that calculates a
current degree of proximity to a preceding vehicle and/or an
extent of influence on the subject vehicle due to future changes
in surrounding environment to predict future driving
10 conditions, based on detection results of the state recognition
device; and
a risk potential calculating device that calculates risk
potential around the subject vehicle based on the future
driving conditions predicted by the future state prediction
15 device and a driver's intentions.
2. A driving assist system for a vehicle according to claim
1, further comprising:
a reaction force calculating device that calculates an
20 operation reaction force to be generated in a vehicle operating
unit according to the risk potential calculated by the risk
potential calculating device; and
a reaction force generating device that generates the
operation reaction force calculated by the reaction force
25 calculating device in the vehicle operating unit.

3. A driving assist system for a vehicle according to claim 2, wherein:

the vehicle operating unit is an accelerator pedal;

5 the reaction force calculating device calculates the operation reaction force to be generated in the accelerator pedal; and

the reaction force generating device generates the operation reaction force in the accelerator pedal.

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4. A driving assist system for a vehicle according to claim 1, further comprising:

a warning system that outputs a warning according to the risk potential calculated by the risk potential calculating device.

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5. A driving assist system for a vehicle according to claim 1, wherein:

the risk potential calculating device estimates the driver's intentions from acceleration and deceleration of the subject vehicle to calculate the risk potential.

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6. A driving assist system for a vehicle according to claim 1, wherein:

25 the risk potential calculating device estimates the

driver's intentions from acceleration and deceleration of the subject vehicle and the preceding vehicle to calculate the risk potential.

- 5 7. A driving assist system for a vehicle according to claim 1, wherein:

the state recognition device detects the vehicle condition and the traveling environment of the subject vehicle including a subject vehicle speed, a preceding vehicle speed,
10 and a distance between the subject vehicle and the preceding vehicle;

the future state prediction device calculates a time headway based on one of a set of the distance between vehicles and the subject vehicle speed and a set of the distance between
15 vehicles and the preceding vehicle speed as the extent of influence due to changes in the surrounding environment; and

the risk potential calculating device calculates the risk potential based on a reciprocal of the time headway.

- 20 8. A driving assist system for a vehicle according to claim 7, wherein:

the risk potential calculating device calculates the risk potential based on a linear sum of the reciprocal of the time headway and a time differentiated value of the reciprocal
25 of the time headway.

9. A driving assist system for a vehicle according to claim 7, wherein:

the risk potential calculating device calculates based
5 on a linear sum of the reciprocal of the time headway, a time differentiated value of the reciprocal of the time headway, and a twice differentiated value of the reciprocal of the time headway.

10 10. A driving assist system for a vehicle according to claim 1, wherein:

the state recognition device detects the vehicle
condition and the traveling environment of the subject vehicle
including a subject vehicle speed, a preceding vehicle speed,
15 and a distance between the subject vehicle and the preceding vehicle;

the future state prediction device calculates time to
contact based on a relative speed and the distance between
vehicles detected by the state recognition device as the degree
20 of proximity to the preceding vehicle; and

the risk potential calculating device calculates the
risk potential based on a reciprocal of the time to contact.

11. A driving assist system for a vehicle according to claim
25 10, wherein:

the risk potential calculating device calculates the risk potential based on a linear sum of the reciprocal of the time to contact, and a time integrated value of the reciprocal of the time to contact.

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12. A driving assist system for a vehicle according to claim 10, wherein:

the risk potential calculating device calculates the risk potential based on a linear sum of the reciprocal of the time to contact, a time integrated value of the reciprocal of the time to contact, and a time differentiated value of the reciprocal of the time to contact.

13. A driving assist system for a vehicle, comprising:
15 a state recognition means for detecting a vehicle condition and a traveling environment of a subject vehicle;
a future state prediction means for calculating a current degree of proximity to a preceding vehicle and/or an extent of influence on the subject vehicle due to future changes in
20 surrounding environment to predict future driving conditions, based on detection results of the state recognition means; and

a risk potential calculating means for calculating risk potential around the subject vehicle based on the future
25 driving conditions predicted by the future state prediction

means and a driver's intentions.

14. A vehicle, comprising:

a vehicle operating unit;

5 a state recognition device that detects a vehicle condition and a traveling environment of a subject vehicle;

a future state prediction device that calculates a current degree of proximity to a preceding vehicle and/or an extent of influence on the subject vehicle due to future changes
10 in surrounding environment to predict future driving conditions, based on detection results of the state recognition device;

a risk potential calculating device that calculates risk potential around the subject vehicle based on the future
15 driving conditions predicted by the future state prediction device and a driver's intentions;

a reaction force calculating device that calculates an operation reaction force to be generated in the vehicle operating unit according to the risk potential calculated by
20 the risk potential calculating device; and

a reaction force generating device that generates the operation reaction force calculated by the reaction force calculating device in the vehicle operating unit.

25 15. A method for calculating risk potential, comprising:

detecting a vehicle condition and a traveling
environment of a subject vehicle;

predicting future driving conditions by calculating a
current degree of proximity to a preceding vehicle and/or an
5 extent of influence on the subject vehicle due to future changes
in surrounding environment based on the vehicle conditions
and the traveling environment having been detected; and

calculating the risk potential around the subject
vehicle based on the predicted future driving conditions and
10 a driver's intentions.

16. A method for calculating risk potential according to
claim 15, wherein:

a time headway is calculated based on one of a set of
15 a distance between the subject vehicle and the preceding
vehicle and a subject vehicle speed and a set of the distance
between vehicles and a preceding vehicle speed as the extent
of influence due to changes in the surrounding environment;
and

20 the risk potential is calculated based on a linear sum
of a reciprocal of the time headway and a time differentiated
value of the reciprocal of the time headway.

17. A method for calculating risk potential according to
25 claim 15, wherein:

a time headway is calculated based on one of a set of a distance between the subject vehicle and the preceding vehicle and a subject vehicle speed and a set of the distance between vehicles and a preceding vehicle speed as the extent
5 of influence due to changes in the surrounding environment;
and

the risk potential is calculated based on a linear sum of a reciprocal of the time headway, a time differentiated value of the reciprocal of the time headway, and a twice
10 differentiated value of the reciprocal of the time headway.

18. A method for calculating risk potential according to claim 15, wherein:

time to contact is calculated based on a relative speed
15 and a distance between the subject vehicle and the preceding vehicle as the degree of proximity to the preceding vehicle;
and

the risk potential is calculated based on a linear sum of a reciprocal of the time to contact and a time integrated
20 value of the reciprocal of the time to contact.

19. A method for calculating risk potential according to claim 15, wherein:

time to contact is calculated based on a relative speed
25 and a distance between the subject vehicle and the preceding

vehicle as the degree of proximity to the preceding vehicle;
and

the risk potential is calculated based on a linear sum
of a reciprocal of the time to contact, a time integrated value
5 of the reciprocal of the time to contact, and a time
differentiated value of the reciprocal of the time to contact.